

Technology Opportunity

Computational Materials/Microgravity Laboratory—A Process Simulation Laboratory

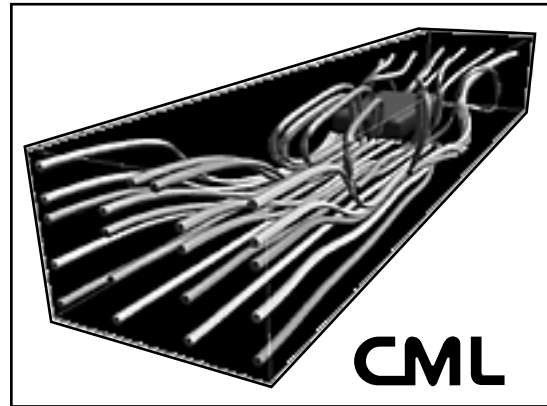
The National Aeronautics and Space Administration (NASA) seeks to transfer the knowledge gained from a decade of pioneering interdisciplinary research in large scale materials processing simulations to aid in improving industrial processes and experimental setups.

Potential Commercial Uses

- Metal casting
- Sand casting
- Fiber drawing
- Solidification of materials
- Chemical vapor deposition
- Chemical vapor infiltration
- Melt infiltration
- Mixing of fluids
- Complex thermal design
- Microscopic/macroscopic level simulations
- Neurostatistical process optimization
- Any other processes involving fluid flows and heat transport

Benefits

Applied numerical modeling allows the examination of processes in great detail without the expense of trying each condition experimentally. Used for the improvement of existing processes and for the design of new processes, it is particularly beneficial in areas where several disciplines merge in commercial application, such as in materials processing. Because there is substantial overhead in acquiring the infrastructure and technical expertise to operate a successful numerical modeling laboratory, it is far more useful, timely, and cost-effective to consult with an existing laboratory with a proven track record in performing complex numerical simulations



The Technology

The Computational Materials/Microgravity Laboratory (CML) has at its disposal a number of widely used commercial codes that are used for modeling fluid flow, heat transfer, and solidification problems. These include FIDAP, FLUENT, Nekton, ProCast, and Polyflow, as well as in-house-developed specialty codes. We have extensive expertise in customizing these codes to capture more sophisticated physics. In many cases, we work directly with the software vendors to improve their products.

Some of our recent clients and their projects include

- AT&T (Lucent Technology): The origin of coating defects during the production of optical fibers was studied. Novel in-house-developed numerical techniques were used not only to obtain an understanding of these defects, but also to suggest process modifications that may have a substantial impact on process quality and yield.
- Crystal Specialties International: Large-scale process simulations of the entire furnace/sample assembly in directional solidification of an



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advanced semiconductor material were performed on client's process. Insight into conditions leading to reduced yield was instrumental in a program to systematically improve the process.

- **Texas Instruments:** Process simulations were performed and staff were trained in the practical application of advanced solidification models. Within a week, the company's researchers were able to understand and perform complex numerical simulations by using modified commercial codes.
- **Robinson Products:** Using a Space Act Agreement with NASA, this small, high-technology, contract R&D company is collaborating with the CML and using its resources for commercial casting applications.
- **Ford Motor Company:** Sand castings have been used as a manufacturing tool for thousands of years with few modifications. Ford has teamed with the CML and others to finally develop a fundamental understanding of the process by which sand flows into molds. With the final goal of improving and accelerating mold design and

operation, Ford and the CML are working in tandem on a combined experimental and numerical program.

- **Commercial CFD Software Vendors:** Close collaborations with commercial code vendors have allowed the CML to influence the direction and capabilities of several well-known commercial codes, including FIDAP, Nekton, and ProCast.

Options for Commercialization

We can handle complex, complicated, sophisticated, ill-defined problems in many facets of industrial processing.

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